

Title: Math in the Garden

Brief Overview:

Students will research, plan, and create a garden using math, science, and technology skills. During the project, students will research the scientific names and characteristics of different types of bulbous flowers. After measuring the perimeter and area of a given plot of land, students will conduct scientific experiments to determine existing soil conditions. Students will then write a persuasive letter to the principal to communicate mathematically the feasibility of planting a garden. Before planting, students will be required to submit a scale drawing of the placement of the bulbs including all measurements. Students will evaluate the accuracy of their scale drawings with their peers. Students will edit and revise their drawings based on suggested recommendations. Students will then predict the estimated height of the flowers and construct an additional scale model including all the features of the garden. The students will then “sell” their plan to their classmates. Through class discussion/debate, the class will collectively critique models and choose the best one. The final stage of the project will have students planting their garden using the appropriate tools required.

Links to Standards:

- **Mathematics as Problem Solving**

Students will demonstrate their ability to calculate area and perimeter of a plot of land. They will brainstorm in groups and critique models in an effort to solve a real-life problem.

- **Mathematics as Communication**

Students will be able to explain their mathematical and scientific reasoning for planting a garden on school property in a persuasive letter to the principal.

- **Mathematics as Reasoning**

Students will use their ability to reason mathematically to make predictions on the growth of the various plants. Students will mathematically justify the placement of the bulbous flowers using their knowledge of flower size and geometry.

- **Mathematical Connections**

Students will be able to connect mathematics with science-related activities and incorporate language arts proofreading strategies and writing skills.

- **Number and Number Relationships**

Students will apply ratios and proportions in their scale drawings. They will calculate percentages of yield of the various flowers. Students will represent estimated and calculated heights in a two dimensional graph.

- **Computation and Estimation**

Students will add, subtract, multiply, and divide whole numbers and fractions. Students will determine the feasibility of their solution to the problem presented. Based on research, students will estimate the projected height of the various flowers.

- **Patterns and Functions**

Students will be able to generalize a relationship between the data collected in the research tables and the expected outcomes of the project.

- **Statistics**
Students will collect, organize, and display data using various methods, including technology.
- **Probability**
Students will predict the probability of the growth of specific bulbs based on the information researched.
- **Measurement**
Students will be able to determine the area and perimeter of the plot of land selected for the growth of the bulbs.
- **Algebra**
Students will be able to write an algebraic equation based on the information given and then use the equation to calculate the depth needed to plant the bulbs.

Grade/Level:

Grades 6-8.

Duration/Length:

This lesson is a long-term project with an emphasis at the beginning of the year for a two-week period and in the spring for a one-week period.

Prerequisite Knowledge:

Students should have working knowledge of the following skills :

- Graphing
- Scientific method of research
- Determining percentages
- Peer evaluation (PQP: Praise, Question and Polish) techniques
- Collecting data
- Using a simple equation
- Adding, subtracting, multiplying, and dividing fractions
- Technology

Objectives:

Students will be able to:

- work cooperatively in groups.
- research information from a variety of sources
- test soil samples for compatibility with bulbs
- evaluate tables for pertinent information needed for a presentation
- construct a scale drawing
- evaluate and critique scale models
- develop a conclusion based on the research

Materials/Resources/Printed Materials:

- Pencils
- Markers/colored pencils
- Paper
- Calculator
- Student worksheets
- Flower bulbs : tulip, daffodil, crocus, hyacinth
- Soil testing kit
- Research on various flower bulbs
- Rulers
- Tape Measure
- Trundle Wheel
- String
- Graph paper
- pH paper
- Catalogs: Dutch Gardens, Inc. 1-800-818-3861
Schipper & Co. 1-800-877-8637
Van Bourgondien & Sons, Inc. 1-800-622-9959
Van Dyek's Flower Farms, Inc. 1-800-248-2852
- Additional Information: <http://www.aac.msstate.edu/pubs/pub1736.htm>

Development/Procedures:

1. State the problem.
Worksheet No. 1: Math in the Garden
2. Students will conduct research.
Worksheet No. 2A: Flower Bulbs
2B: Location
3. Letter to the Principal
Worksheet No. 3A: Writing Prompt
3B: Rubric for Writing Prompt
4. Scale Drawing #1 of the Plot of Land with flower bulb placement
Worksheet No. 4 : Garden Layout Directions/ Scale Drawing #1
5. Peer Evaluation of the drawings
Worksheet No. 5: Peer Evaluation
6. Scale Drawing #2 of Garden with Estimated Heights
Worksheet No. 6: Activity-Specific Key for Scale Drawing #2
(Activity-Specific Key should be given to students for guidance. It will be used by the teacher for grading the project.)
7. Group discussion and preparation for oral presentation.
8. Presentation and group selection of class project.
Worksheet No. 7: Peer Evaluation of Oral Presentations
(Each group will be given sufficient copies of the worksheet to evaluate each of the other groups. After the presentations, each group is required to submit one paragraph to explain and justify their chosen design.)
9. Planting of the Bulbs (Teacher's Hint: Three times the width of the bulb equals the planting depth)

Performance Assessment:

Students will be assessed throughout the project by using the following: rubrics, peer evaluations, checklists, letter writing, scale drawings, activity-specific keys, and research techniques.

Extension/Follow Up:

1. Students will water and care for the plants throughout the year.
They will calculate the percentage of yield of the various bulbs.
They will draw a double bar graph to show the estimated and actual growth of the plants.
2. Students will write a brochure on planting bulbs.

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Worksheet 1: Math in the Garden

Name _____ Date _____ Period _____

Problem:

Welcome to the sixth grade. I know it's early in the year and you are just getting to know the building. You have probably found the gym, your locker and the cafeteria but have you found the garden? Where is the garden you say? Well ... that's part of this project, you are going to build the garden and plant different kinds of flowers.

Step 1: To ensure the survival of your flowers, you will need to investigate what kinds of conditions the flowers need. You will also investigate an area of land around our school and determine if it is suitable for the flowers.

Step 2: Then, you will need to write a letter to your principal and ask permission to use the land. Make sure that you include information that will convince the principal that this location we have selected is ideal for your flowers. Use information from both charts to help support your request.

Step 3: You can plan out the garden using scale drawing #1 which will indicate placement and color of the bulbs. Each individual will create his/her own bulb placement scale drawing #1 which will be edited by your peers.

Step 4: You will use your edited bulb placement scale drawing #1 to predict what the finished garden will look like in the spring. This prediction will take the form of another scale drawing #2 which will reflect the height and color of the flowers.

Step 5: Afterwards, you will form groups of four to select the "best" garden which will represent your group. Each group then will create a presentation which will "sell" their garden to the class. You can do your presentation in a variety of ways. For example you could create a skit or a commercial to convince the class that your group's plan is the best. The class will then vote on which plan of action is the best one.

Step 6: The winners will provide the plan which the whole class will follow when we create the garden. Good Luck and Happy Digging ! May the best plan win!

In the spring, we will continue to investigate our garden. We will work with the graphing calculators to graph our results and will develop a brochure to help the future sixth graders care for our flowers.

Worksheet 2A: Flower Bulbs

The Bulb Data Table : Everything you need to know about your PLANTS

Name _____ Date _____ Period _____

Today you are going to start your project by researching various flower bulbs. Feel free to use any of the books, computers , encyclopedias, catalogs, and magazines that have been made available to you. The internet offers several sites that will help you. Check with your teacher for these addresses.

	TULIPS	DAFFODIL	CROCUS	HYACINTH
Number of bulbs available to plant				
Scientific Name				
Ideal Soil Conditions				
Amount of sun required				
Anticipated height (units)				
Depth required to plant bulb (units)				
Distance between plants (units)				
Special Requirements				

Worksheet 2A: Flower Bulbs (Answer Key)

The Bulb Data Table : Everything you need to know about your PLANTS

Name _____ Date _____ Period _____

Today you are going to start your project by researching various flower bulbs. Feel free to use any of the books, computers , encyclopedias, catalogs, and magazines that have been made available to you. The internet offers several sites that will help you. Check with your teacher for these addresses.

	TULIPS	DAFFODIL	CROCUS	HYACINTH
Number of bulbs available to plant	varies	varies	varies	varies
Scientific Name	tulipa	narcissus	crocus sativus	hyacinthus orientalis
Ideal Soil Conditions	well-drained soil, pH level 5.5 to 7, add fertilizer in spring			
Amount of sun required	Full sun to light shade	Full sun to light shade	Full sun to light shade	Full sun to light shade
Anticipated height (units)	5 to 14"	4 to 18"	3 to 6 "	8 to 10"
Depth required to plant bulb (units)	5 to 8"	5 to 8"	3 to 4"	6"
Distance between plants (units)	4 to 8"	6 to 8"	2 to 4 "	4 to 8"
Special Requirements	Add bone meal below bulb, make sure to water after planting			

Worksheet 2B : Location

The Location Data table : Is This Place Worthy?

Name _____ Date _____ Period _____

You know about the flowers. Now it is time to survey the location of the entire garden. Be sure to include the units when necessary.

	Information about Location
Perimeter of Entire Garden (units)	
Area of Entire Garden (units)	
Biotic Factors (Living)	
Abiotic Factors (Non-living)	
Amount of Sunlight Available (Little, Medium, Full)	
Sources of Water (stream, pipes, rain)	
Nutrients: Levels of Nitrogen, Potassium, and Phosphorus	
pH of soil (1-14)	

Worksheet 3A: Letter to the Principal: Writing Prompt

Name _____ Date _____ Period _____

Writing Prompt

Today's assignment is critical for the success of our project. Today, we need to ask the principal for permission to use the plot of land we have been surveying during the last couple of days of class. In order to obtain this permission, you are going to write a persuasive letter which will include information about the land and how it will be an appropriate spot to grow our bulbs.

In your letter to the principal, you will need to use information from both of your data tables to convince the him/her that this plot of land is a good choice for our garden. Consider the points of soil, sun, water, and space when you are writing your letter. Your garden needs to provide all of these things in order for your bulbs to grow. Your job is to use your research to persuade your principal that your garden can do this.

Considering the topics of soil, water, sunlight, and space, write a persuasive letter to your principal asking permission to create your garden in the given location.

Worksheet 3B: Letter to Principal: Rubric for Writing Prompt

Name _____ Date _____ Period _____

5 Points

- Position was clearly identified and well supported using the science/math vocabulary used in class.
- Language choices including proper grammar, punctuation, and accurate spelling enhanced the text.
- Audience was identified and the needs of the audience were clearly and completely addressed including all points which are to be considered, (according to the directions).
- The organizational plan was maintained and completely supported with accurate research and observed data.

4 Points

- Position was clearly identified and well supported using most of the science/math vocabulary used in class.
- Language choices including proper grammar, punctuation, and accurate spelling enhanced the text.
- Audience was identified and the needs of the audience were clearly addressed including most of points which were to be considered, (according to the directions).
- The organizational plan was maintained and well supported with accurate research and observed data.

3 Points

- Position was identified and supported using some of the science/math vocabulary used in class.
- Language choices including proper grammar, punctuation, and accurate spelling enhanced the text.
- Audience was identified and the needs of the audience were addressed including some of the points which were to be considered, (according to the directions).
- The organizational plan was maintained and supported with research and observed data.

2 Points

- Position was identified and supported using some of the science/math vocabulary used in class.
- Language choices did not reflect one of the following: proper grammar, or punctuation, or accurate spelling. Therefore the text was not "enhanced".
- Audience was identified and the needs of the audience were addressed including some of the points which were to be considered (according to the directions).
- The organizational plan was maintained and supported with research and observed data.

1 Point

- Position was identified and supported using some of the science/math vocabulary used in class.
- Language choices did not reflect one of the following: proper grammar, or punctuation, or accurate spelling. Therefore the text was not "enhanced".
- Audience was identified but the needs of the audience were not fully addressed. A few of the points that were to be considered were included.
- The organizational plan was not maintained and not well supported with research and observed data.

0 Points

- Position was identified but not supported using the science/math vocabulary used in class.
- Language choices did not reflect one of the following: proper grammar, or punctuation, or accurate spelling. Therefore the text was not "enhanced".
- Audience was identified but the needs of the audience were not fully addressed. None of the points that were to be considered were included.
- The organizational plan was not maintained and not well supported with research and observed data.

Worksheet 4: Garden Layout Directions/Scale Drawing #1

Name _____ Date _____ Period _____

1. Measure the Perimeter of the entire garden:

Side 1: _____ ft
Side 2: _____ ft
Side 3: _____ ft
Side 4: _____ ft

Perimeter of garden _____ ft

2. Measure the Area of the entire garden:

Length _____ ft
Width _____ ft

Area of Garden _____ sq. ft

3. Count the number of the different kinds of bulbs:

Tulips _____ Crocus _____ Daffodil _____ Hyacinth _____

4. Using 1/4" graph paper, create a scale drawing of the entire garden. Make your scale large enough to show bulb placement.

5. Using the data from your charts, show the placement of all of the flower bulbs.

Use T = Tulips, C = Crocus, D = Daffodil and H = Hyacinth as your key.

6. If you know the colors of your bulbs, indicate the colors on your drawing by coloring the letter used to indicate bulb placement.

***** *Keep in mind* *****

You want to think about how you want your garden to look in full bloom!

Worksheet 5: Peer Evaluation

Name _____ Evaluator's Name _____

Find a partner from your group. Exchange scale drawings. Critique your partner's scale drawing using the following PQP table.

Praise: Write 3 positive aspects of the drawing.

Question: Ask 3 questions you have about the drawing. Does it make sense to you?

Polish: Give 3 recommendations on how your partner can improve their drawing.

Remember check for:

- mathematical accuracy
- proper key/labeling of bulbs
- neat and detailed drawing

PRAISE	QUESTION	POLISH

Worksheet 6:Scale Drawing #2 Of Garden With Estimated Heights

Performance Assessment

A local nursery has donated a variety of flower bulbs to our school. In order to beautify our school grounds, you will design a scale drawing of the appearance of the garden with the estimated heights of the flowers to present to your classmates. Once your garden design has been presented, the class will vote on which design will be implemented.

As you create your scale drawing, think about the perimeter and area of the garden. Think about the physical characteristics and growth patterns of the flowers. Remember the garden not only needs elements to ensure its survival, but it needs to be visually attractive. Use your knowledge of geometry to give you ideas.

Begin designing your scale drawing of the appearance of the garden with the estimated heights and colors of the flowers to be presented to your classmates .

Activity-Specific Key for Scale Drawing #2

Performance List for

Scale Drawing of Flowers In Bloom

	Possible Points	Points Earned
Key Elements:		
• garden design shows an accurate prediction of the original planting design	_____	_____
• all elements of the garden are accurate according to the scale (length, width, and height of flowers)	_____	_____
• all flowers are accurate according to color	_____	_____
• effective visual display (arrangement of flowers)	_____	_____
• overall neatness of scale drawing	_____	_____
Total	100	

Worksheet 7: Peer Evaluation of Oral Presentations

Rating Scale for Final Garden Design

Group Name: _____

Key Elements:	Rating Scale					
	High					Low
• The scale of the garden design was explained clearly	5	4	3	2	1	0
• The arrangement of the flowers created an effective display	5	4	3	2	1	0
• A clear explanation of the organization of the garden was given	5	4	3	2	1	0
• An explanation of the arrangement of the flowers was justified with supporting details	5	4	3	2	1	0
Total = _____ = _____ %						
20						

Based on your evaluations, choose the best garden design and justify your choice in a brief paragraph.